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MARKETING NASA LANGLEY POLYMERIC MATERIALS
LARSS REPORT

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1 EXECUTIVE SUMMARY

A marketing tool was created to expand the knowledge of LaRC developed polymeric materials, in order to facilitate the technology transfer process and increase technology commercialization awareness among a “non-technical” audience. The created brochure features four materials, LaRC™-CP, LaRC™-RP46, LaRC™-SI, and LaRC™-IA, and highlights their competitive strengths in potential commercial applications. Excellent opportunities exist in the \$40 million per year microelectronics market and the \$6 billion adhesives market. It is hoped that the created brochure will generate inquiries regarding the use of the above materials in markets such as these.

2 INTRODUCTION

2.1 TAG Background

The Technology Applications Group (TAG) at NASA Langley Research Center (LaRC) was formed to facilitate the commercialization of LaRC developed inventions. TAG is subdivided into three business units:

- *The Patent Counsel Office*, who assist LaRC researchers in the completion of the patent application process to protect their inventions, and also provide information about LaRC patents to both NASA personnel and the American business community.
- *The Small Business Partnership Team*, who encourage and fund the development of innovative LaRC technologies through contracts with small (<500 employees) US-owned businesses.
- *The Technology Transfer Team*, who promote the transfer of LaRC developed technologies to the commercial sector, particularly for non-aerospace applications.

The project described in Section 2.3 was developed and supervised by a member of the Technology Transfer Team.

2.2 Composites and Polymers Branch Background

As a branch of the Materials Division, the Composites and Polymers Branch develops improved materials concepts for efficient aerospace structures, including polymeric materials to be used as matrices for fiber-reinforced composites, adhesives for bonding structures, and high-performance films for spacecraft. Currently, twenty-four scientists perform research activities for this branch. As of August 1995, these researchers had filed patents for one hundred and eighty-nine unique materials inventions, all of which are available for transfer to American industry.

2.3 Project Description

The efforts of the Technology Transfer Team are supported by a variety of publications detailing the advantages of utilizing a LaRC developed technology in industrial applications, available through both print and electronic media. However, these marketing tools are often too technical for a layman to understand. This causes an uneven disbursement of information, and can leave public policy-makers, financial decision-makers in companies, and the general public unaware of the benefits of technology transfer to American businesses.

The objective of the project undertaken was to create a multi-functional marketing tool, highlighting polymeric materials developed by researchers from LaRC's Composites and Materials Branch, to be used by the Technology Transfer Team to educate a wide-spread audience about general and specific benefits of the commercialization of these technologies. The end result of this project was to be a brochure, written in layman's terms, detailing the competitive advantages of several LaRC developed polymers, and describing potential non-aerospace industrial applications.

3 ANALYSIS

3.1 Project Methodology

Once the project was defined, a storyboard was created (Figure 1), from which a project methodology was designed.

LaRC material	Point of Contact	Competing Products	Similarities	LaRC Advantages	Applications	Sales Volumes
LaRC™-SI						
LaRC™-IA						
LaRC™-CP						
LaRC™-RP46						

Figure 1

The first step was to interview the points of contact within the Technology Transfer Team, to acquire a general background on the materials and current marketing efforts. After this, time was spent in the NASA Technical Library and the Patent Counsel Office, so that basic technical information on the materials and their competitors could be reviewed. Once this material had been collated, interviews with the researchers took place. During the interview process, the competitive strengths of the materials were discussed, as well as potential applications. After these interviews were completed, it was necessary to investigate market and sales volumes for the potential applications, requiring further research at the library and also interviews with outside contractors who have been involved in the technology transfer process with LaRC.

Once data collection efforts were completed, it was necessary to analyze the information gathered, and determine which materials and applications should be highlighted in the brochure. Materials which filled widespread, high potential market value applications were chosen to represent the Composites and Polymers Branch, since they could generate great interest from the industrial community. Upon completion of this analysis, brochure text was written, which then received feedback from both the researchers and members of the Technology Transfer Team. The results of these efforts are presented in Sections 3.3 through 3.5. After the text was finalized, a brochure layout was designed, graphics were selected, and the brochure was published.

3.2 Utilization of LaRC Resources

Through the course of the project, information was gathered from the following contacts:

- three Technology Transfer Team members
- two Patent Counsel Office members
- twelve Composites and Polymers Branch researchers
- two Research Triangle Institute (RTI) contractors
- one Graphics and Design Section member

The following facilities and physical resources were also used:

- NASA Technical Library, including STILAS and CD-ROM search capabilities
- WWW search facilities
- TAG publications
- RTI publications
- Composites and Materials Branch laboratories
- Graphics and Design section publishing facilities

Figure 2 details time allocations for project activities.

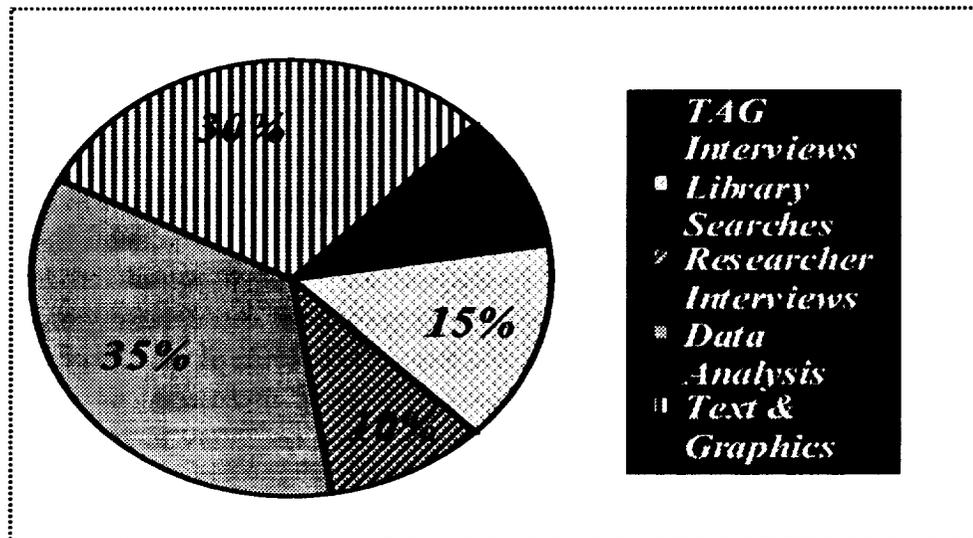


Figure 2

3.3 Competitive Advantages of LaRC Materials

The following table lists the competitive strengths of the LaRC polymers included in the brochure:

Material	Strengths
LaRC Colorless Polyimides (LaRC™-CP)	<ul style="list-style-type: none"> ▫ transparent ▫ soluble ▫ stable in high temperature environments ▫ low water absorption ▫ low dielectric constant ▫ excellent insulative abilities
LaRC™-RP46 Polyimide	<ul style="list-style-type: none"> ▫ lowest cost high temperature matrix resin ▫ non-carcinogenic ▫ twice as strong as competitors ▫ easy to use/process ▫ available in three forms
LaRC Soluble Polyimides (LaRC™-SI)	<ul style="list-style-type: none"> ▫ high strength and flexibility ▫ exceptional electrical insulation ▫ structural and thermal stability from -280°F to 400°F ▫ moisture and flame resistant ▫ chemical and environmental resistance ▫ excellent adhesive strength ▫ easy to process
LaRC Thermoplastic Polyimides (LaRC™-IA)	<ul style="list-style-type: none"> ▫ superior adhesive strength ▫ thermally stable ▫ recyclable ▫ solvent resistant ▫ high processability

3.4 Potential Applications for LaRC Materials

Based on the competitive strengths listed in Section 3.3, the following table lists the highest market value, non-aerospace applications of the LaRC polymers included in the brochure:

Material	Applications
LaRC Colorless Polyimides (LaRC™-CP)	<ul style="list-style-type: none"> ▫ LCD and other Flat Panel Displays ▫ Microelectronics, including Multi-Chip Modules and Flexible Printed Circuit Boards ▫ High Performance Wire Coatings
LaRC™-RP46 Polyimide	<ul style="list-style-type: none"> ▫ Printed Circuit Boards ▫ Automotive Engine Components ▫ Kitchen Ware ▫ Adhesives
LaRC Soluble Polyimides (LaRC™-SI)	<ul style="list-style-type: none"> ▫ Protective Coatings and Adhesives ▫ Electronics and Optics, particularly for Ultra-Thin Multilayer Flexible Circuits ▫ Fabrication of Mechanical Parts
LaRC Thermoplastic Polyimides (LaRC™-IA)	<ul style="list-style-type: none"> ▫ Fire Resistant Foams and Fibers, including use in Residences and Protective Fabrics ▫ Films and Coatings for Printed Circuit Boards and Wire Insulation ▫ Durable Moldings

Estimated 1995 market values for areas of applications are as follows:

- LCD and Flat Panel Displays ≈ \$20 million
- Microelectronics, including printed circuit boards ≈ \$40 million
- Wire Coatings ≈ \$37 million
- Adhesives ≈ \$6 billion

3.5 Competitive Disadvantages of LaRC Materials

There are two disadvantages to be overcome when marketing the LaRC developed materials. The first is a major obstacle for all of the above materials except LaRC™-RP46. Due to economies of scale, it is difficult for the LaRC materials to compete with commercial materials based on cost. Most commercialization opportunities will be based on performance advantages. However, the second disadvantage affects these opportunities. Because NASA funding comes from the public, including companies that produce competitive materials, direct comparisons can not be made between materials developed at LaRC and existing materials. It, therefore, can be difficult to effectively represent the performance advantages of LaRC developed materials, particularly when competing with technologies that are perceived as industry standards.

4 RECOMMENDATIONS & IMPLEMENTATION

4.1 Technology Pull Strategy

Much of the technology commercialization work done by the Technology Transfer Team follows “technology pull” techniques, where companies contact the TAG office regarding a technology which may fill a need of the organization. These inquiries are generated by a variety of stimuli, including the publication materials developed by the Technology Transfer Team. When an inquiry is received, the Technology Transfer Team should identify key non-technical decision makers within the company, and provide them with information that will ease the “pull” of the technology into the organization. The brochure created through this project is an example of the type of information that could be provided.

The brochure, as well as other marketing materials developed for the layman, should also be available to wide-spread audiences, so as to increase the level of awareness in the non-technical community, and possibly increase the number of inquiries regarding LaRC technologies. Distribution channels should include electronic media, as well as public displays. A further area of growth for this type of marketing tool is in non-technical journals and publications.

4.2 Technology Push Strategy

Because the Technology Transfer Team receives many inquiries through the technology pull strategy, LaRC contracts out much of the commercialization work involving “technology push” techniques, where individual companies are targeted for technology acquisition. A need is created within these companies for the benefits that a LaRC developed technology could provide. In instances where the Technology Transfer Team becomes involved with technology push methods, it will be important for them to receive support for the transfer throughout the company’s value chain.

For example, not only would the manufacturer of flexible printed circuit boards receive information regarding LaRC developed technologies, but the company who purchases the flexible circuit boards and the final consumer would also be provided with information. A brochure such as the one created would help these “indirect buyers” of the technology understand the advantages of having a LaRC developed technology within the final product. The acceptance created within these sectors will ease the “push” of the technology into lower layers of the value chain, and could be instrumental in unseating current technology leaders.

5 CONCLUSION

Examining the market values for potential applications for materials developed by LaRC's Composites and Polymers Branch shows that there is a lot to be gained from commercializing the LaRC technologies. Considering that American companies hold a minority market share in most of the applications, there is even more to be gained on an economic level, where international competitiveness and economic growth could be enhanced.

By creating marketing tools that reach a wide-spread audience and may be used in a variety of ways, the Technology Transfer Team can expand the number of opportunities and enhance the level of acceptance for LaRC technologies in commercial applications.